Investigating the long-term impacts of climate change communications on individuals' attitudes and behavior

Rachel A. Howell
Email address: rachel.howell@ed.ac.uk

Abstract
To assess the effectiveness of climate change communications, it is important to examine their long-term impacts on individuals' attitudes and behavior. This article offers an example study and a discussion of the challenges of conducting long-term investigations of behavioral change related to climate change communications (a vital and under-researched area). The research reported is a longitudinal panel study of the impacts on UK viewers of the climate change movie *The Age of Stupid*. The heightened levels of concern, motivation to act, and sense of agency about action that were initially generated by the movie did not measurably persist over the long term. The results also show that behavioral intentions do not necessarily translate into action. Data analysis raised issues concerning the reliability of participants' causal attributions of their behavior. This and other methodological challenges are discussed, and some ways of avoiding or lessening problems are suggested.

Keywords
Climate change communications; Pro-environmental behavior; Behavioral change; Behavioral intentions; Public attitudes

Citation for this article:
Howell, R.A., 2014. Investigating the long-term impacts of climate change communications on individuals' attitudes and behaviour. *Environment and Behavior*, 46(1): 70-101.

In recent years, governments, non-governmental organizations, and individuals have all been involved in creating "climate change communications" aimed at changing public attitudes and behavior related to climate change. These include leaflets and flyers; billboard, press, and television advertisements; short videos and full-length movies; and books of many kinds. Many environmental campaigns appear to be based on the presumption that people simply need more information to behave pro-environmentally. Such campaigns and the "information-deficit" model they are based on have been widely criticized as inadequate to promote behavior change (e.g. Blake, 1999; Kellstedt, Zahran, & Vedlitz, 2008; Ockwell, Whitmarsh, & O'Neill, 2009). Organizations such as Futerra (2005) and the Institute for Public Policy Research (Ereaut & Segnit, 2006), and academics such as Kloeckner (2011), Pooley and O'Connor (2000) and Moser (2007) advise that environmental messages should appeal to the emotions rather than simply providing factual information, to be more engaging. Climate change communications frequently use disaster framing to create a fear appeal intended to motivate mitigation action. One example is the movie *The Age of Stupid*.

Background and study rationale

Disaster framing, fear appeals, and individual agency

Current climate change discourses are often characterized by fear and catastrophe narratives (Doulton & Brown, 2009; Hulme, 2008). Shanahan (2007) argues that catastrophe framing of climate change stories is disempowering. This is important, if true, as a key determinant of action is agency, or efficacy (Bandura, 1977; Grothmann & Patt, 2005). Agency includes not only the perception that one can act effectively but also that it is worth doing so, as individuals are reluctant to take action if they believe that it will make no difference (Hinchcliffe, 1996; Moisander, 2007). Protection Motivation Theory (Rogers, 1975) suggests that we change our behavior in response to fear appeals only when we believe specific behaviors will reduce the threat.

Much of the literature suggests that fear appeals do change attitudes (e.g. Meijnders, Midden, & Wilke, 2001a; 2001b), and promote desirable behavioral intentions (Roser & Thompson, 1995; Sherer & Rogers, 1984). However, O'Neill and Nicholson-Cole (2009) found that fear-based climate change representations do not motivate personal engagement with the issue, while Spence and Pidgeon (2010) found that positive framing produced attitudes towards climate change mitigation that were significantly more positive than those produced by loss frames, and Morton, Rabinovich, Marshall, and Bretschneider (2011) found that positive framing combined with higher uncertainty about outcomes increased individuals' intentions to mitigate climate change, compared with negative framing. Results of studies that investigate actual behavior in response to fear appeals are mixed (e.g. compare Hine & Gifford, 1991, with Leventhal, Singer, & Jones, 1965). Fear appeals need to be combined with high-efficacy messages (useful information about how to avoid the threat) in order not to trigger maladaptive defensive responses (Lewis, Watson, & White, 2010; Moser, 2007; Witte & Allen, 2000). Furthermore, Hastings, Stead, and Webb (2004) assert that there are few field research evaluations of fear appeals, and that laboratory studies of their efficacy are flawed by the over-use of student samples, forced exposure to communications under unrealistic conditions, and short-term measurement of impacts. "Real world" situations, such as this study utilized, might produce different effects: Trumbo & Shanahan (2000), for example, found that increased public concern about climate change in response to dramatic media coverage fades once the coverage lapses.

Behavior: psychological models and contextual factors

Arguably, attempts to change behavior using fear appeals are closely related to Schwartz's (1977) Norm Activation Model, which posits that pro-social behavior is driven by personal norms that depend on an awareness of the consequences of behavior and ascription of responsibility for those consequences. The aim of many climate change communications appears to be to make the consequences of energy use vividly and frighteningly salient to the intended audience, and to promote the idea that mitigating these consequences is the responsibility of individuals. However, this model is a simplistic view of the factors influencing behavior; more recent models are increasingly complex, including many more motivators of, and barriers to, behavioral change.

The influential Theory of Planned Behavior (Ajzen, 1991) suggests that behavior is mediated by behavioral intentions, which are the product not only of attitudes but also of social norms (see Schultz, Nolan, Cialdini, Goldstein, & Griskevicius, 2007) and perceived behavioral control (PBC; one aspect of agency), and that PBC has a direct influence on behavior insofar as it reflects *actual* behavioral control. In other words, contextual factors matter. This insight is reflected in the Attitude-Behavior-Context (ABC) model (Guagnano, Stern, & Dietz, 1995), which states that behavior is influenced by external conditions (such as the provision of recycling bins) as well as attitudes. The Needs-Opportunities-Ability model

of consumer behavior (Gatersleben & Vlek, 1998) also stresses the importance of factors such as the availability of environmentally-friendly products, as well as financial, temporal, cognitive, and physical abilities. Stern (2000) suggests that an explanation of pro-environmental behavior should include the ABC model plus recognition of the influence of personal capabilities and also habit/routine.

Shove (2010), however, critiques psychological models that view "context" as an external driver of behavior, asserting that "conventions that are often taken to constitute the context of behavior have no separate existence" from the practices that reproduce the meanings and know-how associated with such behavior, and therefore that "the driver and the driven are as one" (Shove, 2010, p. 1279). Thus, addressing consumers as isolated actors is not an effective behavior change strategy; there is a need to change the meanings and materials associated with social practices, at a societal, rather than individual, level (Hand, Shove, & Southerton, 2005).

Investigating the impacts of climate change communications

Given these competing theories of behavior and how to stimulate behavioral change, it is important to investigate the impacts of climate change communications on their audiences so as to know whether they achieve their aims, in order that limited resources may be used effectively.

Some work has already been done in this area. For example, O'Neill and Hulme (2009) studied the use of iconic images to engage the public with climate change impacts; Beattie, Sale, & McGuire (2011) explored responses to clips of Al Gore's movie *An Inconvenient Truth*; and Reusswig, Schwarzkopf, and Pohlenz (2004), Balmford et al. (2004), and Leiserowitz (2004) investigated the impact of *The Day After Tomorrow*, a fictional climate change-themed movie. These studies looked at the impact of the communication on respondents' attitudes and beliefs, and, in the case of the two latter studies, behavioral intentions. Given the well-documented "attitude-behavior" or "value-action" gap (Anable, Lane, & Kelay, 2006; Blake, 1999), and research that shows that pro-environmental behavioral intentions do not necessarily correlate with behavior (Bamberg & Möser, 2007; Barr, 2006), it seems clear that if we wish to understand the impact of climate change communications on behavior, we must study individuals' behavior. In some cases, this has been done: for example, Nolan (2010), studying the impact of *An Inconvenient Truth*, asked about behavioral intentions and then checked self-reported behavior one month later. A study of the effects of *The Day After Tomorrow* by Lowe et al. (2006) asked viewers about motivation to act immediately before and after the movie, and then conducted focus group discussions a month later that included discussion about action. My initial study of the impacts of *The Age of Stupid* (Howell, 2011) included a follow-up survey 10–14 weeks after the movie, asking about behavioral change as a result of viewing it, and barriers to desired further change.

There are questions, however, regarding longevity of change: impacts may not persist (Abrahamse, Steg, Vlek, & Rothengatter, 2005). For this reason, Steg and Vlek (2009), in setting out an agenda for research into encouraging pro-environmental behavior, emphasize the need for long-term research. I therefore conducted a further follow-up survey of the impacts of *The Age of Stupid*, a year after my initial research, which is the focus of this article. Research attempting to assess behavioral change is challenging (and less common than studies focusing only on attitudes and intentions), and in the course of analyzing results from this longitudinal study of attitudes and behavior, issues regarding the reliability of the data that can be obtained were identified. The article therefore also highlights and discusses these problems, and potential solutions.

The Age of Stupid

Made with the stated intention "to turn 250 million viewers into climate activists" (AoS, undated), *The Age of Stupid* is a feature-length movie utilizing both documentary and fictional elements to raise awareness of the problem of climate change and its potential impacts. Set in 2055 in a world devastated by climate change, Pete Postlethwaite plays an elderly man living alone in a vast archive, watching news and documentary footage from 2008. This allows an exploration of some of the many contributory factors leading to disaster, through the eyes of a (disheartened) survivor asking, "Why didn't we save ourselves when we had the chance?" Viewers are not directly urged, or told how, to change their behavior, but two of the documentary strands feature people engaged in exemplar actions: calculating their carbon footprint, deciding not to fly on holiday, traveling to France by train, growing vegetables, attending protests, and explaining other ways they have tried to reduce their greenhouse gas emissions. Two policy proposals, contraction and convergence and personal carbon allowances, are also briefly explained. It is an interesting climate change communication to study for various reasons.

First, it had the potential to be influential and to be seen by a wide audience: the movie garnered a lot of media attention ahead of its release in the UK in March 2009, and the director, Franny Armstrong, spoke at several events alongside then-Secretary of State for Energy and Climate Change Ed Miliband. Worldwide release was planned, and achieved in September 2009, and the filmmakers retained distribution rights so that the movie can easily and legally be publicly screened by anyone who pays a license fee to do so. During the first six months after release, more than 1,200 such screenings were organized, and the filmmakers claim that the global premiere was watched by a million people in 63 countries (AoS, undated). Later, the movie was shown on television in the UK, Belgium, Finland, the Netherlands, and Norway during the UN climate conference in Copenhagen in December 2009.

Second, the combination of documentary strands with a fictional dystopian-future frame was unique, distinguishing it from the more usual approaches of previous climate change movies such as *The Day After Tomorrow* (a Hollywood disaster movie) and *An Inconvenient Truth* (a traditional-style documentary), and other types of communications such as campaign advertisements and leaflets, which tend to be factual.

Moreover, unlike many climate change communications, *The Age of Stupid* does not focus on climate science, but instead presents interweaving stories of seven people in different countries to examine inter-related issues of fossil fuel dependency, pollution, extreme weather, and conflict, as well as climate change impacts such as receding Alpine glaciers. Its appeal is to the emotions, and the movie arguably attempts to use fear and guilt as motivators, presenting several "disaster narratives" both fictional and factual – for example, the world devastated by climate change, and images of Hurricane Katrina, oil pollution in Nigeria, and Iraq war refugees.

Finally, although the movie depicts some characters engaging in mitigation behaviors, arguably it does not focus enough (or directly enough) on providing solution messages and inculcating a sense of agency in viewers, as recommended by Protection Motivation Theory.

Thus, *The Age of Stupid* offers an opportunity to explore whether catastrophe framing is an effective communications approach to inspire change, or a disempowering one.

Study aims

The hypothesis was that the movie would raise concern, but that this effect would fade away by the time of the follow-up questionnaires. The study was also designed to assess changes in participants' *fear* of "climate catastrophe", *motivation* to act, sense of *agency* in relation to climate change action, and self-reported *knowledge* about mitigation actions. No hypotheses were made at the outset about how these attitudes and beliefs might change because it seemed

doubtful to conjecture whether *The Age of Stupid* would be experienced as inspiring, motivating, and informative, or whether the "doom and gloom" presentation and lack of direct, specific suggestions for action in the movie would tend to increase fear to a level that would overwhelm feelings of motivation and agency, leaving the audience despairing that personal action is worth taking. Similarly, the study aimed to explore whether the audience took any action as a result of seeing the movie without testing any particular hypotheses about this, as the literature was not conclusive about whether a communication framed in this way would result in actual behavioral changes.

Method

Participants and procedure

The research involved a panel study with participants recruited randomly from among viewers at the Edinburgh Filmhouse during the period 20–24 March 2009. It comprised four surveys: one immediately before seeing the movie (Q1), one immediately afterwards (Q2), a follow-up sent out 10 weeks later (Q3), and a final follow-up in June 2010 (Q4). This "pre/post-test" design has been utilized in similar research (Lowe, et al., 2006; O'Neill & Hulme, 2009; Reusswig, et al., 2004) and was extended in this study by the inclusion of the two follow-up questionnaires. Each respondent's questionnaires were identified by a unique number so that responses could be matched across the longitudinal study. The procedure and survey instruments used for the first three questionnaires are described in more detail in Howell (2011).

The initial surveys (Q1 and Q2) were completed by 241 respondents, of whom 213 agreed to participate in a follow-up. Q3 was completed by 162 people (67.2% of the initial sample); 136 of these agreed to participate in a further follow-up. They were emailed a link to the online final questionnaire and were offered as an incentive to complete it a chance to win one of three £10 vouchers for a store/service of their choice. Two reminders were sent and paper copies were mailed to a few participants who gave only a postal address. Altogether, 105 people completed the final survey, but one questionnaire could not be matched up so had to be discarded, giving a sample for Q4 of 104 respondents (43.2% of the original sample).

Questionnaires

All four questionnaires contained identically-worded questions about attitudes and beliefs related to climate change, so that these could be compared across the period of the research. In addition, each questionnaire included questions unique to that time point of the study. On all four questionnaires the term *climate change/global warming* was used because research by Whitmarsh (2009b) has shown that the terms *climate change* and *global warming* are not entirely synonymous to the general public, and it was important to avoid the study results being affected by the choice of one term over the other.

People often report high levels of concern about environmental issues in isolation, but actually feel more worried about other problems (Defra, 2009; Downing & Ballantyne, 2007; Lorenzoni & Pidgeon, 2006). Thus, on all four questionnaires, respondents were asked an identical question about their level of concern about climate change alongside a variety of other global issues (AIDS, species extinctions, "credit crunch"/recession, poverty, terrorism) so as to determine the relative level. Concern was measured on a 5-point scale from *not at all concerned* to *very concerned* for each issue.

Respondents were also asked on each questionnaire to indicate their agreement on a 7-point scale from *strongly disagree* to *strongly agree* with statements about motivation to act, knowledge of how to cut their carbon footprint, sense of agency, and fear about catastrophic climate change.

On Q3 and Q4, participants were asked multiple-choice questions about whether they had taken, or were engaged in, a number of specific actions. Apart from "awareness-raising", these behaviors were chosen to represent a variety of possibilities in the areas that have highest environmental impacts (home energy, travel, and food; Tukker, et al., 2006, reported in Peattie & Peattie, 2009), ranging from easier actions to those that are likely to be more difficult, expensive, or time-consuming. Most relate to the "headline behavior goals" outlined by the Department for Environment, Food and Rural Affairs (Defra) for government behavior change campaigns to focus on (Defra, 2008). To avoid suggesting an expectation that respondents should be engaged in such behaviors, it was stressed that "Not all will necessarily be possible for you, or you may not want to do them." Questions about behavior were not included on Q1 or Q2 because I was concerned that if these questionnaires were too long or complex, participants would not be willing to complete them during a visit to the cinema. The exclusion of such questions also avoided giving participants ideas about what they could do, and what I might ask about on follow-up questionnaires, protecting Q3 results from one element of distortion. The focus of the research was instead on respondents' self-attributed behavior in response to the movie, captured during the later surveys.

One of the themes of *The Age of Stupid* is the high greenhouse gas emissions associated with flying – a character in the movie says that "other than setting fire to a forest, flying is the single worst thing an ordinary individual can do to cause climate change." The issue is also discussed when a couple decide not to fly on holiday, and there is implicit criticism in the documentary strand about an Indian entrepreneur starting a budget airline. Because of this emphasis, respondents were asked on Q3 about their intentions regarding taking holidays involving flying ("this year" and "long term"); on Q4, in addition to a repeat of the item about long-term intentions, questions about actual and planned holiday flying during 2009 and 2010 were included to ascertain whether the earlier behavioral intentions were carried through.

Socio-demographic data, reasons for seeing the movie, and pre-viewing donations to/involvement with climate change campaign groups were captured on Q1.

Analysis

As the data collected on attitudes and beliefs were ordinal-level data, and were not normally distributed but tended to reveal opinions skewed towards one or the other end of the scales used, nonparametric tests of significance were employed for data analysis. The Friedman test (a nonparametric version of analysis of variance) was used to determine whether there were overall differences between all the questionnaires in respondents' attitudes. Where significant differences were found, this justified using the Wilcoxon signed ranks test to examine the significance of differences between pairs of questionnaires separately.

Results

The results of the first three questionnaires have been published and discussed elsewhere (Howell, 2011); this article focuses on the results of the final survey, how they compare with the previous results, and what we can learn from this about longitudinal studies of this kind. Other than where specified, only results for the 104 people who completed all four surveys are included – and thus some statistics are slightly different from those presented in Howell (2011), which reported results for the larger samples that completed the first questionnaires.

Characteristics of survey respondents

There were no major differences between the initial and follow-up samples with regard to socio-demographic characteristics (see Table 1). Throughout the study there was a bias towards women, and respondents were more highly educated and more likely to be employed

in managerial/professional occupations than the Edinburgh population in the 2001 census. The proportion of respondents in the 35–44 category increased, while the proportion in the 65+ category decreased between the first questionnaires and the final follow-up. Unsurprisingly, therefore, a slightly higher proportion of the final sample was engaged in managerial/professional occupations, and fewer were retired, than was the case for the initial sample.

Table 1. Socio-demographic characteristics of respondents.

		% of responses		
		Q1 and Q2 (*n* = 241)	Q3 (n = 162)	Q4 (n = 104)
Gender	Female	56.0	56.2	57.7
	Male	38.6	40.1	38.5
	Not given	5.4	3.7	3.8
Age	16–24	13.3	13.0	13.5
	25–34	23.2	24.7	23.1
	35–44	17.0	19.1	21.2
	45–54	14.9	13.0	12.5
	55–64	16.2	16.0	18.3
	65+	13.3	13.0	9.6
	Not given	2.1	1.2	1.9
Education	First degree/masters	68.5	68.5	67.3
	PhD	10.0	9.9	9.6
	Lower qualifications	15.3	14.8	15.4
	Not given	6.2	6.8	7.7
Occupation	Managerial/professional[a]	49.0	50.0	53.9
	Retired	17.4	17.3	14.4
	Student	13.3	14.2	14.4
	Intermediate occupations[a]	10.8	9.2	8.6
	Routine/manual occupations[a]	2.5	3.1	3.8
	Unemployed	1.2	1.2	0
	Homemaker	0.4	0	0
	Not given	5.4	4.9	4.8

[a] Occupations given were allocated to these classes as accurately as possible according to the National Statistics Socio-economic Classification (NS-SEC). Where it was not possible to determine the skill level of jobs which might be classed as either managerial/professional or intermediate, they were classed as managerial/professional, and thus this category might be inflated.

However, there *were* important differences between the samples in other respects: it is evident from Figure 1 that those who stayed in the longitudinal study were somewhat more likely than those who dropped out to have agreed on the initial questionnaire with statements demonstrating high levels of interest, concern, motivation, and engagement with climate change groups.

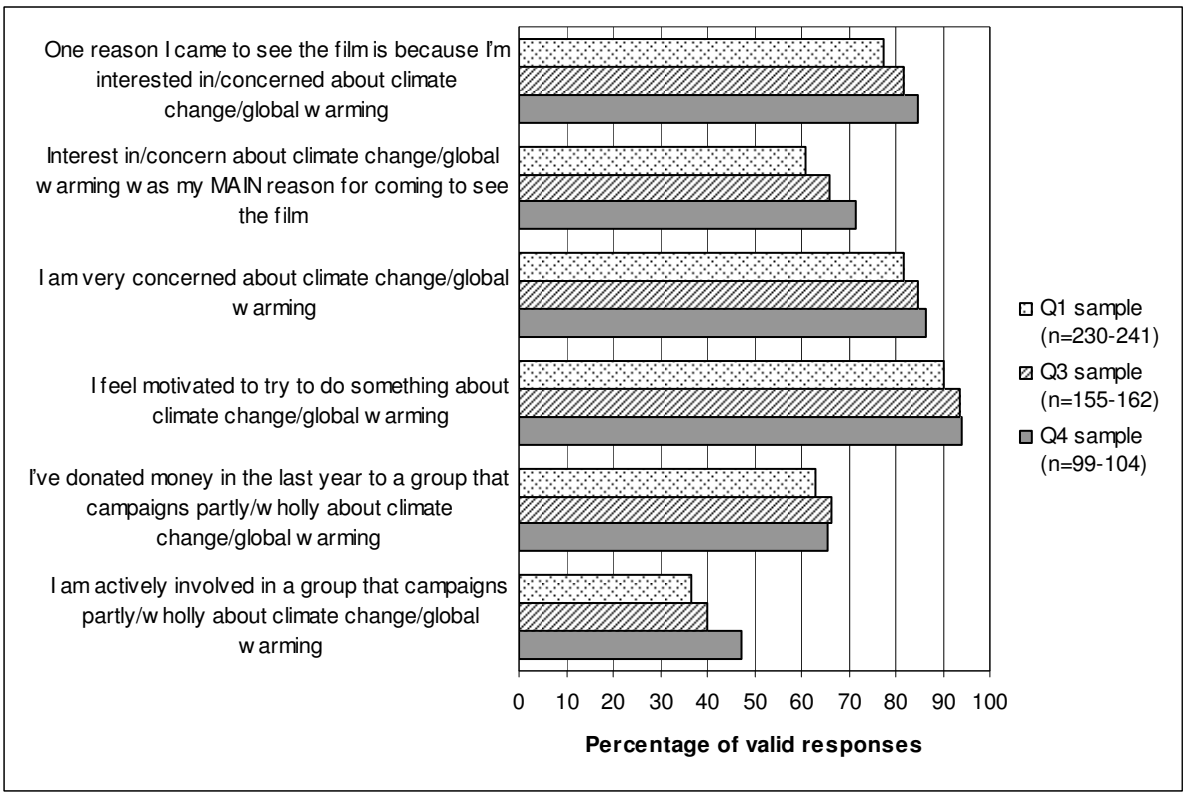

Figure 1. Percentage of respondents in each sample who agreed *on the first questionnaire* with these statements.

Changes in attitudes

Before seeing the movie, 86.5% of respondents reported being "very concerned" about climate change, and 12.5% "somewhat concerned" (Howell, 2011), and the proportion of respondents in those categories was higher for climate change than for any other issue on every questionnaire. Analysis of the first three questionnaires showed that any heightened concern about climate change felt immediately after the movie was a temporary effect (Howell, 2011). Apparent differences in the level of concern between Q4 and other questionnaires were not statistically significant (considering the tests as part of a single family with those reported in Table 2 and applying a Holm's (1979) sequentially rejective Bonferroni adjustment for multiple testing). However, the results for the hypothesis that concern on Q4 was lower than immediately after seeing the movie approached significance ($z = 2.558$, $p = 0.006$ compared with adjusted $p = 0.005$). Fewer participants reported feeling "very" concerned about climate change on Q4 than Q2 (78.8% compared with 89.3%), whereas more described themselves as "somewhat" concerned (17.3% compared with 9.7%). Out of 104 respondents, 16 (15.4%) revised their concern level downwards (by 20 points in total) from Q2 to Q4, whereas 5 (4.8%) revised upwards by one point each.

Agreement with statements about motivation, knowledge, fear, and agency is shown in Table 2. Results of the Friedman test justified further analysis of changes in responses to statements 1, 2, 5, and 6; there were no significant differences in opinions between the four questionnaires for the other statements. Previous results showed that immediately after seeing the movie, respondents exhibited increased motivation to act and belief that they could do something, and decreased agreement with the statement "I do as much as I can about climate change/global warming"; these impacts had faded by the time of the first follow-up (Howell, 2011).

Table 2. Changes in respondents' motivation, knowledge, fear and agency.

	% of valid responses agreeing (n = 100–104)				Comparison to Q4 (Wilcoxon test statistic z)		
Statement	Q1	Q2	Q3	Q4	Q1	Q2	Q3
(1) I feel motivated to try to do something about climate change/global warming	94.0	95.1	92.3	90.4	n.s	–3.507	n.s
(2) I can do something to prevent climate change/global warming getting worse	89.2	94.1	88.4	86.5	n.s	–4.323	n.s
(3) I know what I can do to reduce my carbon emissions	95.0	93.2	94.2	93.3	n.s	n.s	n.s
(4) Cutting my carbon emissions won't make a difference to the problem of climate change/global warming	19.8	22.5	18.2	18.3	n.s	n.s	n.s
(5) It's worth lobbying politicians about climate change/global warming	89.1	88.3	83.7	79.9	–3.551	–2.971	n.s
(6) I do as much as I can about climate change/global warming	66.0	52.0	60.2	64.5	n.s	2.782	n.s
(7) I fear humanity will not do enough to prevent catastrophic climate change/global warming	85.2	87.1	89.5	88.4	n.s	n.s	n.s

Note: n.s = no significant difference; all other results significant at $p \leq 0.005$. Holm's (1979) sequentially rejective Bonferroni method was used to adjust for multiple testing and control the familywise error rate at $\alpha = 0.05$. A negative z value indicates that agreement on Q4 was lower than on other questionnaires.

At the time of the final follow-up, motivation to act and agreement that "I can do something" were again significantly lower than immediately after seeing the movie, but not than the baseline or Q3. Agreement that "I do as much as I can" was significantly higher than immediately after seeing the movie but not than the baseline or Q3. Belief that "It's worth lobbying politicians about climate change/global warming" was lower on Q4 than both Q2 and the baseline (see Table 2 for the test statistics associated with these results).

Behavioral changes

Table 3 shows participants' self-reported behavior. The percentage of respondents who said that they were trying to raise awareness of climate change noticeably decreased between Q3 and Q4, but other changes were small. To test the statistical significance of the differences, an "action score" was constructed for each participant who completed both Q3 and Q4, for each of these two questionnaires, by awarding 1 point for each action taken. Action scores for Q3 ranged from 3 to the maximum of 13, with a mean of 8.46 (SD 1.97), and for Q4 from 2 to 12, with a mean of 8.53 (SD 1.80). A paired samples t-test showed no significant difference between the scores for Q3 and Q4.

Table 3. Percentage of final sample who reported taking specific actions (n = 102–104).

	on Q3[a] %	on Q4[b] %	Net difference in number of respondents
Trying to raise awareness among people I know	89.4	77.7	–13
Home energy use			
Turned down heating/cut time heating on	97.1	89.4	–7
Washing clothes at 30°C (usually/always)	72.8	76.0	+4
Drying clothes on rack or line (usually/always)	93.2	89.4	–3
Changed to "green electricity" supplier/tariff	41.2	38.2	–3
Generating energy through home renewables	5.9	5.8	0
Travel			
Cut down/avoid driving	93.3	91.4	–2
Car sharing/car club (leave blank if never drive)[c]	33.8	27.5	–7
Planning to reduce/stop holiday flying long term	67.0	66.1	–1
Food			
Avoiding buying bottled water	88.5	87.4	–2
Buying more local produce	88.5	89.4	+1
Reduced meat consumption/eat vegetarian/vegan	76.0	75.7	–1
Composting food waste	51.5	53.0	+1

[a] Respondents who answered either "I have done this/am doing it more, because of seeing the film" or "I have done/am doing this, but not because of seeing the film".
[b] Respondents who answered either "I started or increased doing this because of the film and I've continued" or "I am doing this, but not because of seeing the film".
[c] For this statement, n = 77 on Q3 and n = 69 on Q4 because of the instruction to leave the line blank if the respondent never drives.

Table 4 shows respondents' causal attributions for their behavior. Respondents were most likely to state "I am doing this, but not because of seeing the film" with regard to the easier/less costly behaviors, and "I am not currently doing this/can't do this" about the more difficult/expensive options. There were, however, some participants who reported "I started or increased doing this because of the film and I've continued" for every action.

The proportion of respondents who attributed action to the influence of the movie was higher on Q4 than Q3 for most actions. If participants' responses are taken at face value, this could indicate that either (a) the final follow-up was completed only by those most likely to have changed their behavior, or (b) it took some participants a while to begin taking action as a result of seeing the movie. Alternatively, this finding may provide evidence that respondents' causal attributions of their behavior are unreliable. Further examination of the data showed (a) to be untrue, and that although there were a few "late starters" (people who stated that they started or increased action as a result of the movie, but not until after the first follow-up) for most actions (see Table 5), they did not fully account for the increase in the proportion of respondents attributing behavioral changes to the effect of seeing the movie. There were so few of them in each case that this could be "noise" rather than a genuine effect.

Instead, in all cases there were a considerable proportion of people who said on Q3 that they were doing the action but not because of the movie, but on Q4 stated that they started/increased doing it because of the movie and have continued (see Table 5). This only makes sense if they were already taking action before seeing the movie but started doing more because of it, though not until after the first follow-up. It is questionable whether this is really true, especially for such a high proportion of respondents (50% or more of those who attributed action to the effect of seeing the movie for many of the behaviors): it seems unlikely, for example, that those already drying their clothes on a rack, or composting, would do these things more because of seeing the movie, but not until at least two or three months after seeing it. This suggests that participants attributed action to the impact of the movie in retrospect that in fact they were already taking. It is also possible that for some respondents, completion of Q3 acted as a prompt to take (more) action. In either case, it is doubtful

whether one could draw reliable conclusions about the impact of the movie on behavior from these data.

Table 4. Differences between Q3 sample (n = 160–162) and Q4 sample (n = 102–104) in self-attributions of causes of their behavior.

	I am not doing this		I started doing this (more) due to film but this didn't last	I am doing this (more) due to film		I am doing this, but not due to film	
	Q3	Q4	Q4	Q3	Q4	Q3	Q4
Trying to raise awareness among people I know	14.2	14.6	7.8	27.8	20.4	**58.0**	**57.3**
Home energy use							
Turned down heating/cut time heating on	3.7	9.6	1.0	9.3	15.4	**87.0**	**74.0**
Washing clothes at 30°C (usually/always)	26.9	23.1	1.0	10.0	15.4	**63.1**	**60.6**
Drying clothes on rack or line (usually/always)	6.2	9.6	1.0	3.1	1.9	**90.7**	**87.5**
Changed to "green electricity" supplier/tariff	**64.4**	**61.8**	0	4.4	12.7	31.3	25.5
Generating energy through home renewables	**93.2**	**94.2**	0	1.2	1.0	5.6	4.8
Travel							
Cut down/avoid driving	6.8	6.7	1.9	11.7	13.5	**81.5**	**77.9**
Car sharing/car club (leave blank if never drive)[a]	**66.9**	**72.5**	0	0.8	5.8	32.2	21.7
Planning to reduce/stop holiday flying long term	**40.6**	31.1	2.9	21.9	21.4	37.5	**44.7**
Food							
Avoiding buying bottled water	14.2	11.7	1.0	15.4	19.4	**70.4**	**68.0**
Buying more local produce	12.3	8.7	1.9	17.9	19.2	**69.8**	**70.2**
Reduced meat consumption/eat vegetarian/vegan	27.8	22.3	1.9	8.6	12.6	**63.6**	**63.1**
Composting food waste	**49.1**	**47.1**	0	2.5	6.9	48.4	46.1

Note: Figures are percentages of valid responses and the most common response to each statement on each questionnaire is highlighted in bold.

[a] For this statement, n = 118 on Q3 and n = 69 on Q4 because of the instruction to leave the line blank if the respondent never drives.

Table 5. Results of comparisons between Q3 and Q4 of causal self-attributions for behavior.

	No. of respondents who attributed action to the film on Q4		
	Total	Who said on Q3 they were not taking this action: "late starters"	Who on Q3 attributed action to something other than the film
Trying to raise awareness among people I know	21	1	8
Home energy use			
Turned down heating/cut time heating on	16	0	12
Washing clothes at 30°C (usually/always)	16	4	4
Drying clothes on rack or line (usually/always)	2	0	2
Changed to "green electricity" supplier/tariff	13	4	6
Generating energy through home renewables	1	0	1
Travel			
Cut down/avoid driving	14	1	9
Car sharing/car club (leave blank if never drive)	4	0	2
Planning to reduce/stop holiday flying long term	22	2	6
Food			
Avoiding buying bottled water	20	1	10
Buying more local produce	20	1	7
Reduced meat consumption/eat vegetarian/vegan	13	3	4
Composting food waste	7	3	4

Comparing behavioral intentions and action

To examine whether participants' behavioral intentions were reflected in later behavior, expected counts assuming no correlation between intention and action were calculated for flying behavior, based on the proportion of the sample who gave each one of three possible answers to the questions on Q3 about intentions regarding holiday flying. If intentions translate into action, the responses on Q4 to the questions about flights actually taken should be significantly different to these expected counts.

Twenty people who completed Q4 had stated on Q3 that they were planning to take holidays without flying during 2009 because of seeing the movie; of these, 9 did fly on holiday, and 11 did not. These figures are very similar to the expected counts assuming no correlation between intention and action: 10 people to take a flight and 10 not to do so. (The calculated expected counts just happen to work out as a 50/50 split in this case; this was not assumed.) Out of 22 Q4 respondents who had said on Q3 that they had decided to reduce/cut out holiday flying *long term* because of seeing the movie, 12 said they would not be taking a holiday flight in 2010, compared with the 10 expected assuming no correlation between intention and action, 7 said they had/would (one less than expected), and 3 said they "possibly" or "probably" would (again, one less than expected). Of course, taking a holiday flight during 2010 does not necessarily mean that a person has given up a decision to "cut down" on holiday flying, but neither do these results give a very clear indication that participants are acting on their intentions.

However, respondents who intended to holiday without flying for reasons other than seeing the movie were more likely to carry out their intentions. There is a significant correlation in the data (Cramér's $V = 0.461$, $p < 0.001$) between respondents who said on Q3 that they would not be flying that year "but not because of the film" and those who reported on Q4 that they had not flown in 2009. Those who stated on Q3 that they had decided to reduce/cut out holiday flying *long term* "but not because of the film" were also more likely ($V = 0.268$, $p = 0.005$) to report on Q4 that they would not be taking a holiday flight during 2010 (57.4%, compared with 17.6% who had not decided to cut holiday flying).

Discussion

Long-term impacts of The Age of Stupid

The hypothesis tested by this study is that although a movie of this kind is likely to make climate change more immediately salient and bring related fears to the forefront of viewers' minds, any heightened level of concern felt straight after seeing the movie would not persist long term. There is some evidence to suggest that this was the case, although the differences in levels of concern between this final follow-up and the other questionnaires were not statistically significant. It may be that the tests did not have enough power to detect significance, given the sample size and number of comparisons performed, or that the response scale was not sensitive enough and should have been extended at the top (e.g. *extremely*; *very*; *quite a lot*; *somewhat*, rather than just *very* and *somewhat*), to differentiate between different but high levels of concern. Alternatively, since those who remained in the survey to the end were most likely to demonstrate the highest concern to begin with, the lack of significant changes might simply reflect that the movie had very little measurable effect on concern among these self-selected moviegoers. It may indicate that many respondents had already reached the highest level of ongoing concern that they could sustain while continuing their everyday lives.

This does not mean that a movie like this cannot contribute to raising awareness and long-term concern about climate change; it may be that it would have a clearer long-term impact on viewers who were less engaged with the subject before seeing the movie, especially as it might add to a general build-up of concern arising from many different sources, or pave

the way for another communication or event to have more of an impact. Marketing research shows that exposure to several linked advertisements over time increases recall and can contribute to desired attitudes (Vakratsas & Ambler, 1999; Zielske, 1959).

The "disaster framing" of the movie did not, in general, leave the audience sampled feeling disempowered or inclined to maladaptive defensive responses; possible explanations for this, based on the self-selecting and unrepresentative nature of this audience, are discussed in Howell (2011). No hypotheses were made about how participants' attitudes and beliefs might have changed between Q3 and the final follow-up, because although it seemed likely that the heightened motivation to act and sense of agency engendered by the movie would not persist directly because of it, it did seem possible that if respondents had started taking action as a result of the movie, that might impact on their attitudes. The finding that where there had been a change immediately after seeing the movie, agreement with most of the statements presented in Table 2 reverted to the baseline level by the time of Q4 (except for belief in the worth of lobbying politicians, which was lower than the baseline by Q4), suggests that this was not especially the case, but again, this may be because participants in the study were already so engaged with the issue from the outset that their attitudes were developed and stable. A control group with which to compare long-term attitudinal changes would be useful, but in this non-laboratory situation it would have been difficult to recruit a sample with the same characteristics as the moviegoers (which were not known until after analysis of the initial questionnaire), who would commit not to watch the movie for 15 months. As there appear to be no long-term attitudinal impacts of the movie, the lack of a control group means that the most likely risk of error is that the longitudinal impacts are underestimated, in that it is possible that had participants *not* seen the movie, their concern, motivation, and sense of agency might have fallen below the baseline over 15 months.

As regards behavioral changes that respondents attributed to seeing the movie, responses to the final follow-up questionnaire suggest that, by and large, participants persisted with changes they had made. There was also possibly some evidence of a "late starter" effect – that it took time for some people to begin taking action as a result of seeing the movie, so the changes they made were not captured by the first follow-up questionnaire. For certain actions, these late starters made up a significant proportion of the total who claimed to have started or increased doing the action because of the movie (see Table 5); in the case of switching to a "green electricity" tariff or supplier, adopting a reduced meat diet, and setting up a composting system, it is certainly not surprising that it might take some time to make these changes. If responses are taken at face value, the study therefore suggests that the movie might have had a greater effect than was initially apparent, but this is not a robust conclusion given the small numbers of respondents concerned. On the other hand, the questions about flying revealed that actual behavior was much more likely to be correlated with an intention not to fly for a reason other than seeing the film (perhaps an existing pro-environmental commitment, or because of financial constraints) than with a resolve made after watching the movie. This should not surprise us: research has shown that energy conservation is often undertaken for reasons other than (or in addition to) concern about climate change (Whitmarsh, 2009a); moreover, the theories about behavior discussed earlier suggest that, as behaviors are complex products of personal psychological features and contextual factors, it is likely that even many very engaged individuals need more than just the stimulus of watching a movie to give up a popular behavior. The potential for greater or lesser impacts than are obvious from a short-term follow-up, as revealed by the analysis of Q4 compared with Q3, shows the importance of considering impacts over a time-span of months to years, rather than just immediate changes or a period of a few weeks.

Implications for using movies to communicate about climate change

Because they are able to present complex information in an intelligible way, and to emotionally engage their audiences, movies have significant potential as a means of

communicating about climate change. They allow viewers to feel that they are right there "at the scene," and (in documentaries at least) being addressed directly by the characters. However, behavior change theory implies that movies like *The Age of Stupid* that focus mostly on raising awareness of the problem may be more likely to change attitudes than behavior, and be better suited for audiences who are not already very engaged with the issue (Howell, forthcoming). This study suggests that the audience attracted to watch a movie like *The Age of Stupid* does not fit that description. The inclusion of Al Gore's documentary *An Inconvenient Truth* in the school curriculum in several countries (Nolan, 2010) means that it may be reaching a more appropriate audience; research investigating the impacts on schoolchildren would be worth conducting.

If directors wish to promote behavioral change rather than raise awareness and increase (possibly only short term) concern, Protection Motivation Theory suggests that they should incorporate solution messages into their movies, including perhaps portraying more characters taking action, to model behaviors and make them more familiar to audiences. Furthermore, in order to capitalize on the heightened concern felt immediately after viewing, movies could be coupled with other interventions at the time of screening, such as public pledges, goal setting, and formulating behavior implementation intentions. Although this study has shown that intentions do not always translate into action, encouraging people to make specific public pledges and plans can be effective (Bamberg, 2000; Cobern, Porter, Leeming, & Dwyer, 1995). The makers of *The Age of Stupid* tried to ensure that screenings during the opening week were accompanied by talks and information stalls provided by various organizations, to encourage viewers to get actively involved in local groups and campaigns. The movie also did offer viewers a sense of moral support and encouragement regarding what they were already doing (Howell, 2011), so communications like this may have a role to play in reinforcing existing pro-environmental behavior.

Problems with longitudinal studies of climate change communications impacts

The first issue this research exposes is that of the recruitment and retention of respondents who are not "the converted" (as several put it). Participants who remained in this study seemed to be those most concerned about climate change at the outset, and the whole sample showed more concern about climate change compared with other issues than respondents in other studies (Defra, 2007, 2009; Norton & Leaman, 2004). This was despite the fact that incentives were offered at each stage of the survey for completion of the questionnaires. It is generally likely to be difficult to study the impact of climate change communications such as movies, talks, or workshops on the "general public" by recruiting among those who attend them voluntarily, as such initiatives often "preach to the converted" (Auldsmith, 2009). Other methods are necessary and sometimes used (see next section).

Second, the study raises the question of the reliability of causal self-attributions of behavior. Problems have been identified with using self-report measures of behavior (Chao & Lam, 2011; Corral-Verdugo, 1997; Manfredo & Shelby, 1988); respondents tend to over-estimate their pro-environmental or pro-social behavior, perhaps because of a desire to offer socially desirable responses or because their self-identity as a "green" or "socially responsible" person leads them to assume that their behavior correlates more with their values than it actually does. Requesting attributions of causes for that behavior adds another layer of complexity. The Fundamental Attribution Error is well-established: observers tend to attribute others' behavior to disposition, ignoring the influence of situational constraints (Jones & Harris, 1967); actors themselves are more likely to explain their behavior in terms of the context in which they act (Nisbett, 1973; Storms, 1973). People like to justify effort that they expend (Aronson & Mills, 1959), which might lead respondents to attribute behavior changes to the effects of a movie they had voluntarily seen (traveling a fair distance in some cases, for example, from St Andrews). Moreover, individuals underestimate the influence of social norms on their behavior (Nolan, Schultz, Cialdini, Goldstein, & Griskevicius, 2008). These

studies, and the social practices literature mentioned earlier, show that there are influences on behavior that individuals are often unaware of.

To these problems this study adds the finding that, given a lapse of time, individuals sometimes offer causal attributions for their behavior that contradict previous attributions. In this case, participants were more likely after fifteen months than at the time of the earlier follow-up to attribute their self-reported behavior to the influence of the movie. Leaving aside the issue of unrecognized influences on behavior, it is not surprising that over time people forget exactly what consciously prompted them to adopt certain actions; it may be that respondents who were sympathetic to the aims of the movie were over-inclined to attribute behavior to its impact as their memory became faultier with temporal distance from the screening. Another possibility is that prior questions on Q4 about the influence of *The Age of Stupid* primed respondents to attribute actions to the impact of the movie when they were asked about these, more than questions on Q3 did, again because of the greater time lapse between Q4 and the screening creating more memory problems. Dijksterhuis, Preston, Wegner, and Aarts (2008) show how priming individuals using certain words alters attribution of authorship of subsequent events.

Related to this is the difficulty of isolating the impacts of one "intervention" when there are so many other events or pieces of information that may influence behavior. Newspaper coverage of climate change has significantly increased in recent years, for example (Boykoff, 2008; Doulton & Brown, 2009; Weingart, Engels, & Pansegrau, 2000).

Completion of the questionnaires themselves could have influenced respondents' attitudes or acted as a prompt for action, as hinted by one who commented that Q3 "was in itself thought-provoking." Although care was taken to frame questions in a neutral way, a questionnaire cannot avoid focusing attention on particular issues and ideas, and in this case, actions, that the participants might not otherwise have considered. Thus the collection of the data renders its reliability suspect when it comes to the attribution of impacts.

It is clear from the results concerning holiday flying that behavioral intentions cannot be assumed to be proxies for actual behavior. These results do not show that intentions never translate into action; for example, respondents reported in the "other comments" section: "My biggest change has been not flying anymore. I have made two trips from Germany to Scotland without flying […] I will try to continue doing this", and "I now ration my air travel to one flight per year." However, intentions are often more pro-environmental than observed behavior (Chao & Lam, 2011). What is interesting in this study is that intentions that existed independently of the movie *did* correlate well with behavior. If emissions reductions motivated these intentions, rather than financial or other considerations, this result indicates that some pro-environmental intentions, perhaps those developed over a longer period of time, may predict behavior well. Further long-term research would be needed to explore this possibility.

Finally, I offer a note on statistical analysis of studies of attitudes and behavior. It is common to report the mean of questions that use a single-item Likert-type response format, and to use parametric tests such as the *t*-test to analyze this kind of data (e.g. Chib, Chiew, Kumar, Choon, & Ale, 2009; Lowe, et al., 2006; Pooley & O'Connor, 2000). However, these statistics were developed for interval-level data (Kurzon, Urbancheck, & McCabe, 1996; Siegel & Castellan, 1988), but on a question of concern, for example, we cannot be sure that the difference between *somewhat* and *very* concerned is the same as the difference between *not at all* and *a little* concerned, or any two other response points. The comparison of means may therefore be problematic and there is controversy over whether parametric tests may be used with this type of data (e.g. Carifio & Perla, 2007; de Winter & Dodou, 2010; Knapp, 1990). Instead, one can use nonparametric tests, as in this analysis (although there is not a neat substitute for the mean of a response item, which is a very accessible way of giving an overall idea of the strength of opinions). Nonparametric tests can have greater power than parametric tests when distributions are skewed (as was the case for most items on the

questionnairesreported here, where opinions tended to cluster at one end of the spectrum; de Winter & Dodou, 2010). One can also create a true "Likert scale" involving several items to test attitudes (Carifio & Perla, 2007), although single items that are well-designed can be as valid as multi-item scales (Gardner, Cummings, Dunham, & Pierce, 1998). Alternatively, there may be some justification for designing questions in such a way that the response format approximates an interval scale, for example by using a visual analogue scale, a line on which participants are asked to place a cross to indicate their response anywhere between the two anchor end-points (see, for example, Vickers, 1999, who discusses the advantages and disadvantages of this method compared with the use of ordinal response measures). Researchers would be well-advised to be aware of this debate and to pay careful attention to the design and analysis of questions so as to be able to justify their choice of parametric or nonparametric statistics.

Overcoming research problems

It is vital that we attempt to address problems with longitudinal studies of the impacts of climate change communications, because we need to know how these communications affect both attitudes and behavior long term.

For some studies, the recruitment and retention of a representative sample does not matter; we might wish to study the impact of an intervention on those who voluntarily participate in it, and indeed to find out whether or not it *is* the general public who participate, and if not, in what ways the sample differs from the rest of the population. This was the approach taken with this study of the impact of *The Age of Stupid*. Otherwise, for communications not received by everyone (such as leaflets through mailboxes), one can recruit a sample and present the communication to them at a specially arranged presentation. Student samples are frequently used, as in the study on the impact of *The Day After Tomorrow* by Nolan (2010), but these are also not representative in terms of age, background, education, or income. A really robust study would recruit a representative random sample from the general population, but this takes time and is likely to require offering significant incentives for participation, especially for a longitudinal study.

To overcome the problems of relying on self-report behavior, Steg and Vlek (2009) advise measuring actual behavior where possible. Chao and Lam (2011) recommend using multi-report methods such as diaries, observed behavior, and meter readings. They trained students to observe particular aspects of the behavior of their roommates in university dormitory accommodation and compared these reports with self-reports of the observed subjects. This requires a living or workplace situation where subjects' behavior can be readily observed – not so easy in a culture where sharing space with people other than one's own family is unusual past the student years. If done without the consent of the subjects it could also raise ethical issues, but seeking consent could then lead to socially desirable behavior from subjects who are aware that they are under scrutiny.

Research that asks respondents to provide information such as gas/electricity meter and odometer readings, and number of flights in the past year, at the beginning of the study and then again at later points, could provide very accurate information about how a communications initiative has affected participants' carbon footprints, although it would not be able to show exactly how changes were achieved (e.g., does fewer miles driven indicate fewer places visited, more consolidated journeys, or more sharing with others?). Eliciting the latter information would involve interviews or a detailed survey. Corral-Verdugo, Zaragoza, and Guillen (1999) found that asking respondents for quantified measures of behavior led to more accurate self-reports. However, these kinds of data are not easy to collect from an unprepared sample; participants who do not have diaries/energy bills etc to hand and have little time are unlikely to be able to provide reliable estimates.

To test for the effect that using questionnaires, diaries, or other reporting measures might have on behavior, a control group can be used that either does not complete some of the

reporting tasks, or is not exposed to the "intervention" but does do all the reporting. Nolan (2010) used this approach in a study of the impact of Al Gore's movie *An Inconvenient Truth*: her control group did not complete the questionnaire asking about behavioral intentions at the time of seeing the movie like other respondents, but simply answered the follow-up questionnaire later.

Similarly, to address the difficulty of isolating the impacts of one communication, one can compare the sample with a sample that does not experience the intervention under study. In his research into the impacts of *The Day After Tomorrow*, Leiserowitz (2004) conducted a telephone survey involving both moviegoers and those who did not see the movie. Staats, Harland and Wilke (2004), investigating the influence of involvement in EcoTeams, included questions about pro-environmental behavior that were identical to those asked in an annual survey of a representative sample of the general public, and thus were able to see whether changes made by their EcoTeam respondents were replicated in the population as a whole.

In conclusion, overcoming problems of longitudinal studies that assess the impacts of climate change communications will generally require significant time and financial resources. However, it is important that such studies are conducted, as this research has demonstrated both the potential for long-term effects (including possibly some that take time to emerge), and the fact that other changes may be merely short-term, while intentions do not necessarily translate into action. The conclusions that could be drawn from the first time periods of my study were not the same as those that emerged from the later phases. Thus short-term studies might fail to adequately capture the impacts of climate change communications on attitudes, and especially behavior, which it is vital for policymakers and practitioners (such as non-governmental organizations and filmmakers) to understand.

Acknowledgements

Grateful thanks to Dave Reay, Pete Higgins, and Charles Warren, who supervised this study, and to the anonymous reviewers who provided helpful comments. This research was supported by a studentship from the Scottish Alliance for Geosciences, Environment and Society (SAGES).

References

Abrahamse, W., Steg, L., Vlek, C., & Rothengatter, J. A. (2005). A review of intervention studies aimed at household energy conservation. *Journal of Environmental Psychology, 25*, 273-291.

Ajzen, I. (1991). The Theory of Planned Behavior. *Organizational Behavior and Human Decision Processes, 50*, 170-211.

Anable, J., Lane, B., & Kelay, T. (2006). An Evidence Base Review of Public Attitudes to Climate Change and Transport Behaviour. London: Department for Transport.

AoS. (undated). Age of Stupid website. Retrieved April 16, 2012 from http://www.spannerfilms.net/films/ageofstupid.

Aronson, E., & Mills, J. (1959). The effect of severity of initiation on liking for a group. *Journal of Abnormal and Social Psychology, 59*, 177-181.

Auldsmith, J. (2009). Are we switching on? Challenges and opportunities for climate change education in Scotland. Edinburgh: Scottish Education and Action for Development.

Balmford, A., Manica, A., Airey, L., Birkin, L., Oliver, A., & Schleicher, J. (2004). Hollywood, Climate Change, and the Public. *Science, 305*, 1713.

Bamberg, S. (2000). The Promotion of New Behavior by Forming an Implementation Intention: Results of a Field Experiment in the Domain of Travel Mode Choice. *Journal of Applied Social Psychology, 30*, 1903-1922.

Bamberg, S., & Möser, G. (2007). Twenty years after Hines, Hungerford, and Tomera: A new meta-analysis of psycho-social determinants of pro-environmental behaviour. *Journal of Environmental Psychology, 27*, 14-25.

Bandura, A. (1977). Self-efficacy: Toward a Unifying Theory of Behavioral Change. *Psychological Review, 84*, 191-215.

Barr, S. (2006). Environmental Action in the Home: Investigating the 'Value-Action' Gap. *Geography, 91*, 43-54.

Beattie, G., Sale, L., & McGuire, L. (2011). An inconvenient truth? Can a film really affect psychological mood and our explicit attitudes towards climate change? *Semiotica, 187*, 105-125.

Blake, J. (1999). Overcoming the 'Value-Action Gap' in Environmental Policy: tensions between national policy and local experience. *Local Environment, 4*, 257-278.

Boykoff, M. T. (2008). The cultural politics of climate change discourse in UK tabloids. *Political Geography, 27*, 549-569.

Carifio, J., & Perla, R. J. (2007). Ten Common Misunderstandings, Misconceptions, Persistent Myths and Urban Legends about Likert Scales and Likert Response Formats and their Antidotes. *Journal of Social Science, 3*, 106-116.

Chao, Y., & Lam, S. (2011). Measuring Responsible Environmental Behavior: Self-Reported and Other-Reported Measures and Their Differences in Testing a Behavioral Model. *Environment and Behavior, 43*, 53-71.

Chib, A., Chiew, H. J., Kumar, C., Choon, L. G., & Ale, K. (2009). [minus]plastic: influencing pro-environmental attitudes among Singaporean youth. *Environmental Education Research, 15*, 679-696.

Cobern, M. K., Porter, B. E., Leeming, F. C., & Dwyer, W. O. (1995). The Effect of Commitment on Adoption and Diffusion of Grass Cycling. *Environment and Behavior, 27*, 213-232.

Corral-Verdugo, V. (1997). Dual 'realities' of conservation behavior: Self-reports vs. observations of reuse and recycling behavior. *Journal of Environmental Psychology, 17*, 135-145.

Corral-Verdugo, V., Zaragoza, F., & Guillen, A. (1999). The effect of quantification on the accuracy of proenvironmental behavior self-reports. *Journal of Environmental Systems, 27*, 101-112.

de Winter, J. C. F., & Dodou, D. (2010). Five-Point Likert Items: *t* test versus Mann-Whitney-Wilcoxon. *Practical Assessment, Research & Evaluation, 15*, 1-7.

Defra. (2007). 2007 Survey of Public Attitudes and Behaviours Toward the Environment. London: Department for the Environment, Food and Rural Affairs.

Defra. (2008). A Framework for Pro-Environmental Behaviours. London: Department for Environment, Food and Rural Affairs.

Defra. (2009). 2009 Survey of public attitudes and behaviours towards the environment. London: Department for the Environment, Food and Rural Affairs.

Dijksterhuis, A., Preston, J., Wegner, D. M., & Aarts, H. (2008). Effects of subliminal priming of self and God on self-attribution of authorship for events. *Journal of Experimental Social Psychology, 44*, 2-9.

Doulton, H., & Brown, K. (2009). Ten years to prevent catastrophe? Discourses of climate change and international development in the UK press. *Global Environmental Change, 19*, 191-202.

Downing, P., & Ballantyne, J. (2007). Tipping Point or Turning Point? Social marketing and climate change. London: Ipsos MORI.

Ereaut, G., & Segnit, N. (2006). Warm Words: How are we telling the climate story and can we tell it better? London: Institute for Public Policy Research.

Futerra. (2005). The Rules of the Game: Principles of Climate Change Communication. London: Futerra.

Gardner, D. G., Cummings, L. L., Dunham, R. B., & Pierce, J. L. (1998). Single-item versus multiple-item measurement scales: An empirical comparison. *Educational and Psychological Measurement, 58*, 898-915.

Gatersleben, B., & Vlek, C. (1998). Household Consumption, Quality of Life, and Environmental Impacts: A Psychological Perspective and Empirical Study. In K. J. Noorman & T. S. Uiterkamp (Eds.), *Green Households? Domestic Consumers, Environment and Sustainability*. London: Earthscan.

Grothmann, T., & Patt, A. (2005). Adaptive capacity and human cognition: The process of individual adaptation to climate change. *Global Environmental Change, 15*, 199-213.

Guagnano, G. A., Stern, P. C., & Dietz, T. (1995). Influences on Attitude-Behavior Relationships: A Natural Experiment with Curbside Recycling. *Environment and Behavior, 27*, 699-718.

Hand, M., Shove, E., & Southerton, D. (2005). Explaining Showering: a Discussion of the Material, Conventional, and Temporal Dimensions of Practice: Sociological Research Online10. Available at: http://www.socresonline.org.uk/10/2/hand.html (accessed 01.05.2012).

Hastings, G., Stead, M., & Webb, J. (2004). Fear Appeals in Social Marketing: Strategic and Ethical Reasons for Concern. *Psychology and Marketing, 21*, 961-986.

Hinchcliffe, S. (1996). Helping the earth begins at home: The social construction of socio-environmental responsibilities. *Global Environmental Change, 6*, 53-62.

Hine, D. W., & Gifford, R. (1991). Fear Appeals, Individual Differences, and Environmental Concern. *Journal of Environmental Education, 23*, 36-41.

Holm, S. (1979). A simple sequentially rejective multiple test procedure. *Scandinavian Journal of Statistics, 6*, 65-70.

Howell, R. A. (2011). Lights, camera ... action? Altered attitudes and behaviour in response to the climate change film *The Age of Stupid*. *Global Environmental Change, 21*, 177-187.

Howell, R. A. (forthcoming). How might climate change films encourage individual behavioural change? An analysis using the stages of change model. *International Journal of Sustainable Development*.

Hulme, M. (2008). The conquering of climate: discourses of fear and their dissolution. *The Geographical Journal, 174*, 5-16.

Jones, E. E., & Harris, V. A. (1967). The attribution of attitudes. *Journal of Experimental Social Psychology, 3*, 1-24.

Kellstedt, P. M., Zahran, S., & Vedlitz, A. (2008). Personal Efficacy, the Information Environment, and Attitudes Toward Global Warming and Climate Change in the United States. *Risk Analysis, 28*, 113-126.

Kloeckner, C. A. (2011). Towards a Psychology of Climate Change. In W. L. Filho (Ed.), *The Economic, Social and Political Elements of Climate Change*. Berlin: Springer-Verlag.

Knapp, T. R. (1990). Treating ordinal scales as interval scales: an attempt to resolve the controversy. *Nursing Research, 39*, 121-123.

Kurzon, W. M., Urbancheck, M. G., & McCabe, S. (1996). The seven deadly sins of statistical analysis. *Annals of Plastic Surgery, 37*, 265-272.

Leiserowitz, A. (2004). Before and After The Day After Tomorrow: A U.S. Study of Climate Change Risk Perception. *Environment, 46*, 22-37.

Leventhal, H., Singer, R., & Jones, S. (1965). Effects of fear and specificity of recommendation upon attitude and behavior. *Journal of Personality and Social Psychology, 2*, 20-29.

Lewis, I. M., Watson, B., & White, K. M. (2010). Response efficacy: The key to minimizing rejection and maximising acceptance of emotion-based anti-speeding messages. *Accident Analysis and Prevention, 42*, 459-467.

Lorenzoni, I., & Pidgeon, N. F. (2006). Public views on climate change: European and USA perspectives. *Climatic Change, 77*, 73-95.
Lowe, T., Brown, K., Dessai, S., de Franca Doria, M., Haynes, K., & Vincent, K. (2006). Does tomorrow ever come? Disaster narrative and public perceptions of climate change. *Public Understanding of Science, 15*, 435-457.
Manfredo, M. J., & Shelby, B. (1988). The Effect of Using Self-Report Measures in Tests of Attitude-Behavior Relationships. *Journal of Social Psychology, 128*, 731-743.
Meijnders, A., Midden, C. J. H., & Wilke, H. A. M. (2001a). Communications About Environmental Risks and Risk-Reducing Behavior: The Impact of Fear on Information Processing. *Journal of Applied Social Psychology, 31*, 754-777.
Meijnders, A., Midden, C. J. H., & Wilke, H. A. M. (2001b). Role of Negative Emotion in Communication about CO_2 Risks. *Risk Analysis, 21*, 955-966.
Moisander, J. (2007). Motivational complexity of green consumerism. *International Journal of Consumer Studies, 31*, 404-409.
Morton, T. A., Rabinovich, A., Marshall, D., & Bretschneider, P. (2011). The future that may (or may not) come: How framing changes responses to uncertainty in climate change communications. *Global Environmental Change, 21*, 103-109.
Moser, S. C. (2007). More bad news: the risk of neglecting emotional response to climate change information. In S. C. Moser & L. Dilling (Eds.), *Creating a Climate for Change: Communicating Climate Change and Facilitating Social Change*. New York: Cambridge University Press.
Nisbett, R. E. (1973). Behavior as seen by the actor and as seen by the observer. *Journal of Personality and Social Psychology, 27*, 154-164.
Nolan, J. M. (2010). "An Inconvenient Truth" Increases Knowledge, Concern, and Willingness to Reduce Greenhouse Gases. *Environment and Behavior, 42*, 643-658.
Nolan, J. M., Schultz, P. W., Cialdini, R. B., Goldstein, N. J., & Griskevicius, V. (2008). Normative Social Influence is Underdetected. *Personality and Social Psychology Bulletin, 34*, 913-923.
Norton, A., & Leaman, J. (2004). The Day After Tomorrow: Public Opinion on Climate Change. London: MORI Social Research Institute.
O'Neill, S. J., & Hulme, M. (2009). An iconic approach for representing climate change. *Global Environmental Change, 19*, 402-410.
O'Neill, S. J., & Nicholson-Cole, S. (2009). "Fear Won't Do It": Promoting Positive Engagement With Climate Change Through Visual and Iconic Representations. *Science Communication, 30*, 355-379.
Ockwell, D., Whitmarsh, L., & O'Neill, S. (2009). Reorienting climate change communication for effective mitigation: forcing people to be green or fostering grass-roots engagement? *Science Communication, 30*, 305-327.
Peattie, K., & Peattie, S. (2009). Social marketing: A pathway to consumption reduction? *Journal of Business Research, 62*, 260-268.
Pooley, J. A., & O'Connor, M. (2000). Environmental Education and Attitudes: Emotions and Beliefs Are What is Needed. *Environment and Behavior, 32*, 711-723.
Reusswig, F., Schwarzkopf, J., & Pohlenz, P. (2004). Double Impact: The Climate Blockbuster The Day After Tomorrow and its Impact on the German Cinema Public. Potsdam, Germany: Potsdam Institute for Climate Impact Research Report 92.
Rogers, R. W. (1975). A Protection Motivation Theory of Fear Appeals and Attitude Change. *Journal of Psychology, 91*, 93.
Roser, C., & Thompson, M. (1995). Fear Appeals and the Formation of Active Publics. *Journal of Communication, 45*, 103-121.
Schultz, P. W., Nolan, J. M., Cialdini, R. B., Goldstein, N. J., & Griskevicius, V. (2007). The Constructive, Destructive, and Reconstructive Power of Social Norms. *Psychological Science, 18*, 429-434.

Schwartz, S. H. (1977). Normative influences on altruism. In L. Berkowitz (Ed.), *Advances in experimental social psychology Vol. 10*. New York: Academic Press.
Shanahan, M. (2007). Talking about a revolution: climate change and the media. London: International Institute for Environment and Development.
Sherer, M., & Rogers, R. W. (1984). The Role of Vivid Information in Fear Appeals and Attitude Change. *Journal of Research in Personality, 18*, 321-334.
Shove, E. (2010). Beyond the ABC: climate change policy and theories of social change. *Environment and Planning A, 42*, 1273-1285.
Siegel, S., & Castellan, N. J. (1988). *Nonparametric Statistics for the Behavioral Sciences, Second Edition*. New York: McGraw-Hill.
Spence, A., & Pidgeon, N. F. (2010). Framing and communicating climate change: The effects of distance and outcome frame manipulations. *Global Environmental Change, 20*, 656-667.
Staats, H., Harland, P., & Wilke, H. A. M. (2004). Effecting Durable Change: A Team Approach to Improve Environmental Behavior in the Household. *Environment and Behavior, 36*, 341-367.
Steg, L., & Vlek, C. (2009). Encouraging pro-environmental behaviour: An integrative review and research agenda. *Journal of Environmental Psychology, 29*, 309-317.
Stern, P. C. (2000). Toward a Coherent Theory of Environmentally Significant Behavior. *Journal of Social Issues, 56*, 403-424.
Storms, M. D. (1973). Videotape and the attribution process: Reversing actors' and observers' points of view. *Journal of Personality and Social Psychology, 27*, 165-175.
Trumbo, C. W., & Shanahan, J. (2000). Social research on climate change: Where we have been, where we are, and where we might go. *Public Understanding of Science, 9*, 199-204.
Tukker, A., Huppes, G., Guinée, J., Heijungs, R., de Koning, A., van Oers, L., Suh, S., Geerken, T., Van Holderbeke, M., Jansen, B., & Nielsen, P. (2006). Environmental impact of products (EIPRO): Analysis of the life cycle environmental impacts related to the total final consumption of the EU25. Brussels: IPTS/ESTO Project, European Commission Joint Research Centre.
Vakratsas, D., & Ambler, T. (1999). How Advertising Works: What Do We Really Know? *Journal of Marketing, 63*, 26-43.
Vickers, A. J. (1999). Comparison of an ordinal and a continuous outcome measure of muscle soreness. *International Journal of Technology Assessment in Health Care, 15*, 709-716.
Weingart, P., Engels, A., & Pansegrau, P. (2000). Risks of communication: discourses on climate change in science, politics, and the mass media. *Public Understanding of Science, 9*, 261-283.
Whitmarsh, L. (2009a). Behavioural responses to climate change: Asymmetry of intentions and impacts. *Journal of Environmental Psychology, 29*, 13-23.
Whitmarsh, L. (2009b). What's in a name? Commonalities and differences in public understanding of "climate change" and "global warming". *Public Understanding of Science, 18*, 401-420.
Witte, K., & Allen, M. (2000). A Meta-Analysis of Fear Appeals: Implications for Effective Public Health Campaigns. *Health Education and Behavior, 27*, 591-615.
Zielske, H. A. (1959). The Remembering and Forgetting of Advertising. *Journal of Marketing, 23*, 239-243.